Kentucky. Dept. of Health

Maternal Mortality in Kentucky

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A Study of Puerperal Deaths

1932 - 1939

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Division of Maternal and Child Health

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FOREWORD

"Maternal Mortality in Kentucky" is a study which was made in an attempt to define more accurately the problem of maternal deaths in Kentucky. This study is a collection and analysis of the statistical data on file in the State Department of Health. It indicates facts only as they appear in numbers. This is the second of a series of four mortality reports, of purely statistical nature, on maternal, neonatal, infant and preschool deaths.

The material here presented is primarily intended to be used by public health workers, physicians and interested laity for study and reference work alone. In no sense is it a description of the activities of the Division of Maternal and Child Health as they relate to the program directed toward reduction in morbidity and mortality of mothers.

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MATERNAL MORTALITY IN KENTUCKY

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INTRODUCTION

Deaths among women from causes directly or indirectly associated with childbearing have long presented a serious problem to the medical profession. Spectacular progress in the reduction of death rates from many causes has not been paralleled by a decline in the death rates from puerperal causes. Failure to show marked improvement in maternal death rates is the more significant when it is realized that modern obstetrics has evolved from a neglected and relatively insignificant department of medical practice to a highly specialized one. Great progress has been made in the understanding and treatment of the more serious abnormalities of pregnancy and delivery.

The maternal death rate in Kentucky has shown only a slight decline since 1911. In 30 years this rate has declined approximately two deaths per 1,000 live births. Two observations are made from the trend of maternal death rates in Kentucky: (1) the trend is downward and (2) the State rate has been consistently lower than that for the United States. However, it is believed much can be done to further reduce puerperal deaths. The maternal death rate in Kentucky has varied irregularly from the highest rate, 8.1 deaths per 1,000 live births in 1918 to 4.1 per 1,000 live births in 1939.

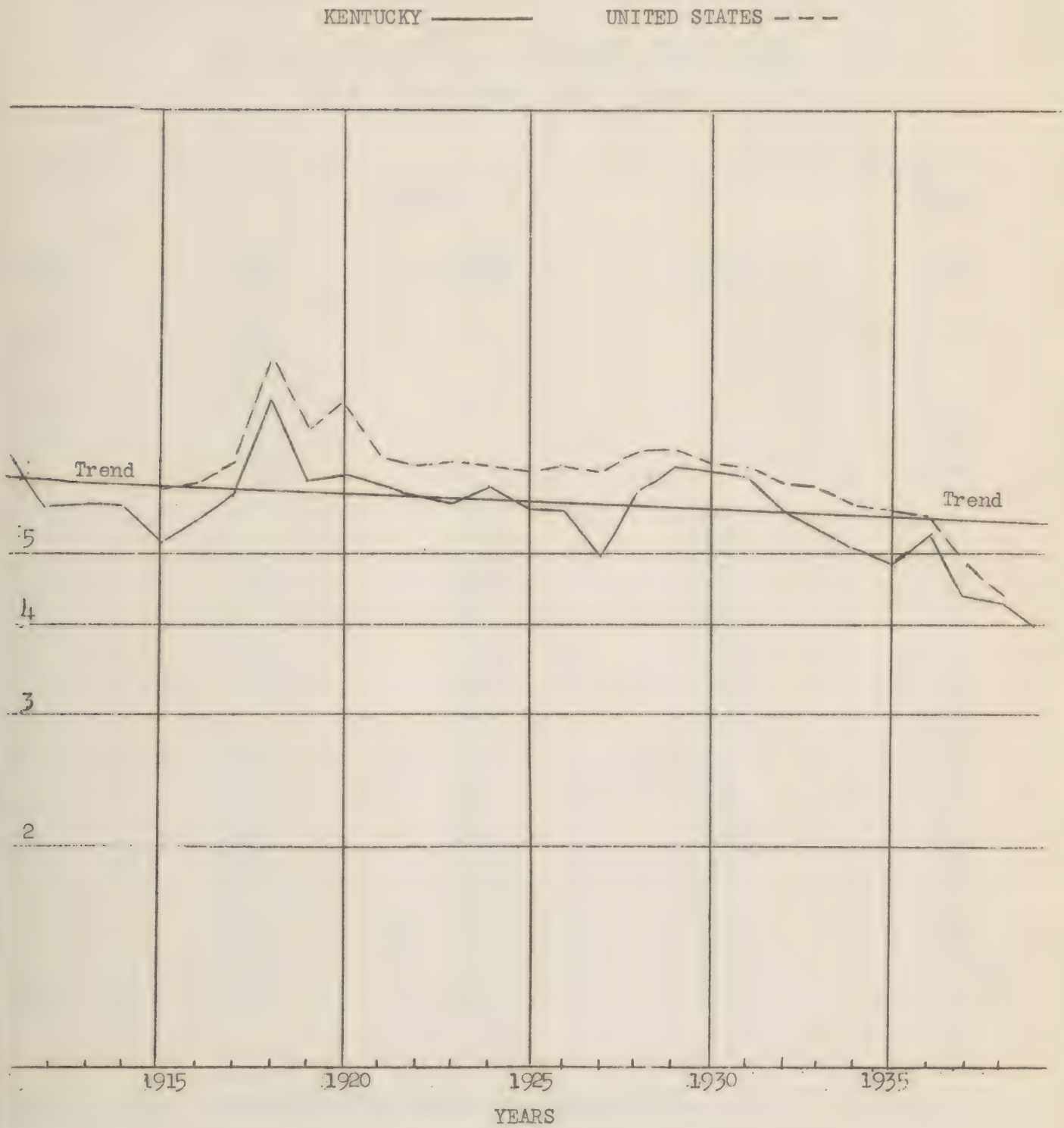
STATEMENT REGARDING THE STUDY

The trend of maternal deaths in Kentucky has been observed from the puerperal death rates for the years 1911 - 1939. An analysis of maternal death certificates for 1932 - 1937 inclusive, was made in an effort to determine the number of deaths by age of mother, race, cause, and place of occurrence. Birth certificates of infants

born to mothers who died from puerperal causes in 1937 were studied to determine the parity and attendant at delivery.

The statistical data on puerperal deaths here presented is not satisfactory or complete. It is understood that a study made by investigation of maternal deaths within a given period of time is much more conclusive, but very expensive. The study of the maternal death situation in Kentucky was made by the personnel of the Maternal and Child Health Bureau, who made the analysis, and the personnel of the W. P. A. Health Project in the State Department of Health, who compiled the data. The figures are necessarily crude; they are unavoidably subject to error, revealing facts merely as they appear in numbers. But these numbers indicate, beyond question, the presence of a situation disturbing in the extreme. These are the deaths of an isolated and socially significant class, women in the active childbearing years, and as such they must be of searching concern to the medical profession and society in general.

MATERNAL MORTALITY RATES FOR KENTUCKY (1911 - 1939) AND
UNITED STATES (1915 - 1938); DEATHS PER 1,000 LIVE BIRTHS
(TREND FOR KENTUCKY BASED ON RATES 1911 - 1936)



(Logarithmic scale is used to show relative decline)

GRAPH I

TABLE I

MATERNAL DEATH RATES PER 1,000 LIVE BIRTHS FOR KENTUCKY (1911 - 1939)

WHITE AND NEGRO RATES FOR KENTUCKY (1919 - 1939)

U. S. TOTAL RATES (1915 - 1938)

	KENTUCKY			U. S.
YEAR	TOTAL	WHITE	NEGRO	TOTAL
1911	6.7			
1912	5.8			
1913	5.9			
1914	5.8			
1915	5.2			6.1
1916	5.5			6.2
1917	6.1			6.6
1918	8.1			9.2
1919	6.3	5.9	12.4	7.4
1920	6.5	6.0	12.4	8.0
1921	6.2	5.7	13.7	6.8
1922	6.0	5.5	13.1	6.6
1923	5.9	5.4	15.6	6.7
1924	6.2	5.7	12.9	6.6
1925	5.8	5.2	13.9	6.5
1926	5.8	5.5	10.3	6.6
1927	5.1	4.7	9.8	6.5
1928	6.1	5.7	12.7	6.9
1929	6.6	6.1	13.5	7.0
1930	6.5	6.0	13.8	6.7
1931	6.4	6.0	12.5	6.6
1932	5.8	5.4	13.0	6.3
1933	5.5	4.8	16.0	6.2
1934	5.1	4.4	10.8	5.9
1935	4.9	4.5	11.9	5.8
1936	5.3	5.0	9.7	5.7
1937	4.4	4.4	4.1	4.9
1938	4.3	4.0	8.3	4.4
1939	4.1	3.9	7.9	

Source of Data: U. S. Mortality Statistics, 1911 - 1938.

Kentucky Statistical Bulletins, 1937 - 1939.

RACE:

The Negro maternal mortality rates have been greatly in excess of the white rates (Table I) except for 1937 when the Negro maternal death rate fell below the white for the first time in the history of the vital statistics registration in the State. No explanation is made for this experience. It is observed that both the white and Negro rates are declining. The rate of decline of the white maternal death rates, however, has been more than the Negro.

TABLE II

WHITE AND NEGRO MATERNAL DEATH RATES BY RURAL AND URBAN AREAS

IN KENTUCKY

1932 - 1938

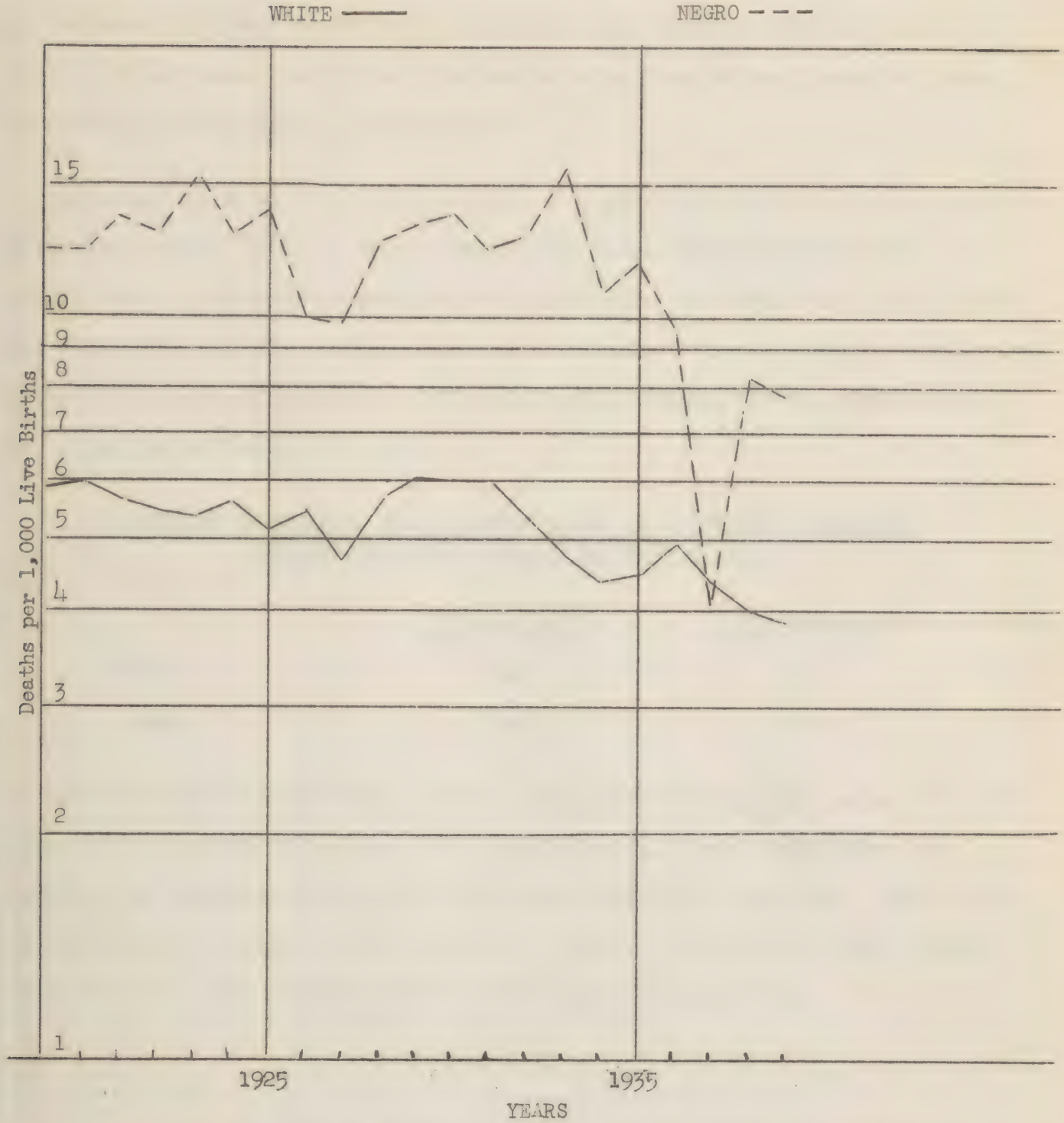
YEAR	WHITE RURAL	WHITE URBAN	NEGRO RURAL	NEGRO URBAN
1932	4.0	6.8	7.4	14.1
1933	4.3	5.3	12.1	13.5
1934	4.2	8.1	9.4	14.3
1935	4.0	6.5	9.6	17.9
1936	4.7	6.3	8.9	10.2
1937	3.6	7.9	4.1	4.2
1938	3.4	6.3	9.5	9.3

When observed by rural and urban areas, some important differences are noted. The above data, derived from deaths tabulated by place of occurrence, show that the Negro urban rates are highest of any observed (1932 - 1938).

A larger proportion of urban than rural mothers are delivered in hospitals, where they presumably receive better care. In 1935, 48% of the total deliveries in the State were made in hospitals. In the rural section such deliveries aggregated only

MATERNAL MORTALITY RATES FOR KENTUCKY BY RACE; 1919 - 1939

DEATHS PER 1,000 LIVE BIRTHS



(Logarithmic scale is used to show relative increase and decrease)

GRAPH II

1.5% of the total rural deliveries. Twenty-six percent of the rural deliveries were made by midwives. It should be remembered, however, that many rural mothers are delivered in urban hospitals. Consequently, the maternal mortality rates for urban and rural women, based upon data tabulated by place of occurrence of births and deaths, contain errors of unknown size.

A maternal mortality rate for the residents of a given community should be based on births to women living in that community and deaths from puerperal cause, of women living in the same community regardless of where the births and deaths occur. Such resident maternal mortality rates can be calculated from the special tabulations of births and maternal deaths for 1935 made by the Division of Vital Statistics of the United States Bureau of Census.

COMPARISON OF MATERNAL DEATH RATE BY PLACE OF OCCURRENCE (RECORDED) AND RESIDENT DEATH RATE IN KENTUCKY - 1935

	RECORDED RATE	RESIDENT RATE
Urban	8.5	7.8
Rural	4.6	5.0

The urban recorded rate was 85% higher than the corresponding rural rate. The urban resident rate was 56% higher than rural resident rate. Even though rates are corrected for residence, the urban rate remains higher than the rural. This is in keeping with the finding for the country as a whole. The urban resident rate was higher than the rural resident rate in 29 of the 48 States in 1935.

GRAPH III

LIVE BIRTHS VERSUS MATERNAL DEATHS BY AGE OF MOTHER; % OF TOTAL

KENTUCKY - COMPOSITE NUMBERS

1932 - 1936

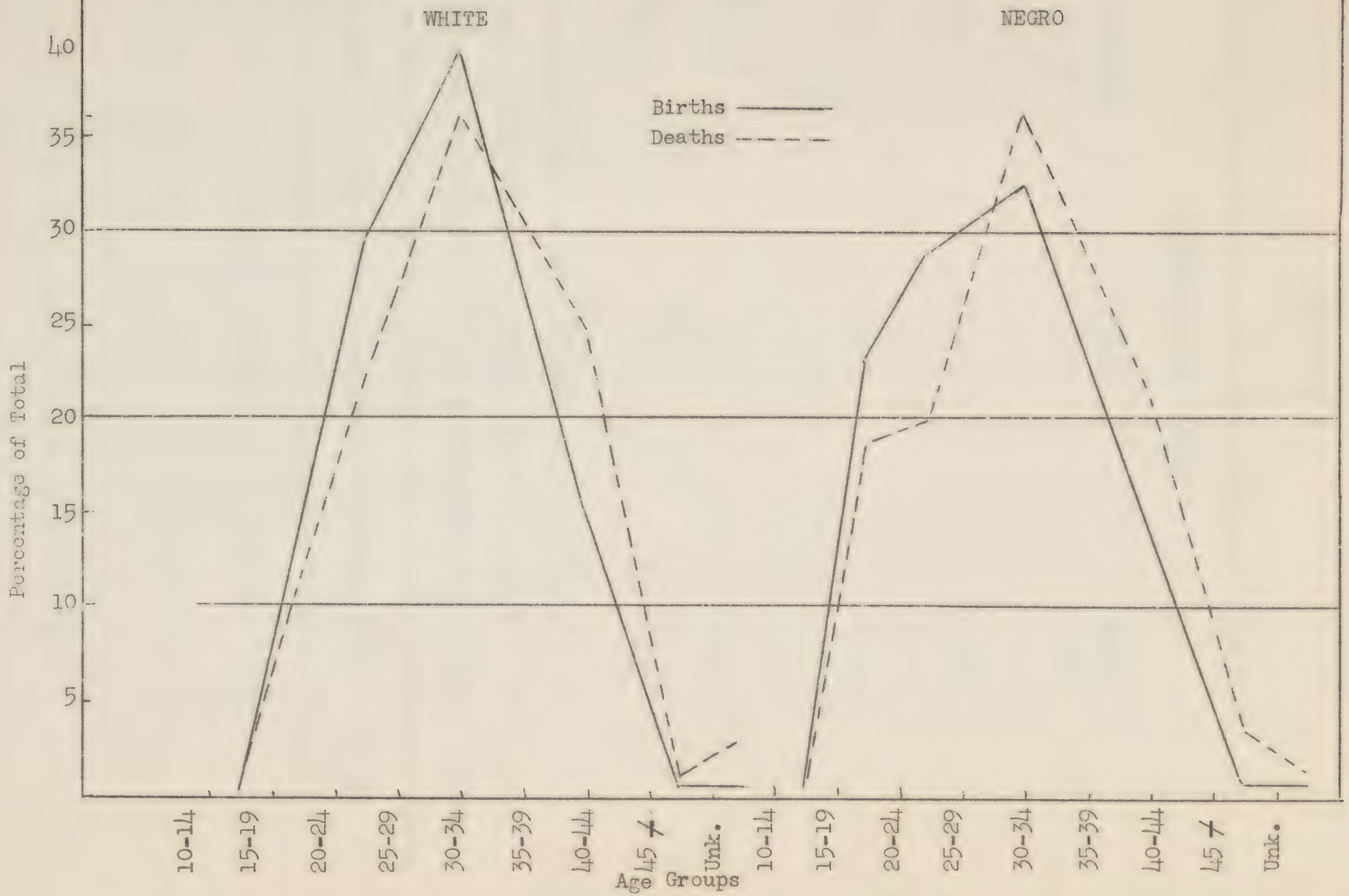


TABLE III

MATERNAL DEATH RATES PER 1,000 LIVE BIRTHS BY AGE GROUPS

KENTUCKY, 1932 - 1936

AGE GROUPS	WHITE	NEGRO
10 - 14	18.6	6.8
15 - 19	3.6	9.2
20 - 24	3.5	7.7
25 - 29	3.9	11.0
30 - 34	4.7	13.3
35 - 39	7.4	12.6
40 - 44	8.5	31.0
Unknown	8.8	83.3
TOTAL	4.7	11.2

The maternal mortality rates for Negro mothers exceeded those for white mothers at every age (above table) except for mothers under 14. Ages 10 - 14 are early ages for childbearing, but in this five year period 1932-1936, 146 Negro mothers and 493 white mothers between the age of 10 and 15 gave birth to liveborn children. Rates for both Negro and white mothers were lowest in the age period 20 to 24 years (3.5 per 1,000 live births for white, as compared with 7.7 for Negroes). It is observed that the rate is more than twice as high for the Negroes.

The maternal mortality rate for the Negro mothers in Kentucky exceeded that for white mothers by 140% for the period 1932-1936. In the Southern states in 1935 the rate for Negro mothers exceeded that for white mothers by 69%; and in the Northern states by 86%. The greater excess percentage in the Northern than in the Southern states is due essentially to the lower mortality rates for white mothers in the North. The maternal mortality rates for Negroes in the two sections (9.6 for Northern states and 9.5 for Southern states in 1935) are very similar.[1]

When the percentage of total live births by age groups is compared with the percentage of total maternal deaths by age groups, it is observed: (Tables IV and V)

(1) The percentage of total maternal deaths is greater than the percentage of total live births beginning in the age group 25 - 34 among Negroes and in the age group 35 - 44 among the white.

(2) Greatest disparity between the percentages is in the age group 20 - 24 for both white and Negro, the percentage of total maternal deaths being less than the percentage of total live births. This is an indication that the safest period of childbearing is in this age group.

[1] Tandy, Elizabeth C.: Infant and Maternal Mortality among Negroes. Journal of Negro Education, July, 1937; page 340.

TABLE IV

PERCENTAGE OF TOTAL LIVE BIRTHS VERSUS PERCENTAGE OF TOTAL MATERNAL DEATHS BY AGE OF MOTHER - KENTUCKY - COMPOSITE NUMBERS, 1932-1936

Age Groups	Number Live Births	Percentage of Total Live Births	Number Deaths	Percentage of Total Maternal Deaths
10 - 14	639	0.2	9	0.6
15 - 19	44,411	15.4	190	13.2
20 - 24	85,227	29.7	319	22.1
25 - 34	111,970	39.0	519	36.0
35 - 44	42,728	14.9	350	24.2
45 and over	1,357	0.5	20	1.4
Unknown	831	0.3	36	2.5
TOTAL	287,163	100.0	1,443	100.0

TABLE V

PERCENTAGE OF TOTAL LIVE BIRTHS VERSUS PERCENTAGE OF TOTAL MATERNAL DEATHS BY AGE OF MOTHER: WHITE AND NEGRO - KENTUCKY - COMPOSITE NUMBERS, 1932 - 1936

Age Groups	Number Live Births	Percentage of Total Live Births	Number Deaths	Percentage of Total Maternal Deaths
		WHITE		
10 - 14	493	0.2	8	0.6
15 - 19	40,790	15.0	158	12.4
20 - 24	80,742	29.7	286	22.5
25 - 34	106,925	39.4	457	36.0
35 - 44	40,541	14.9	313	24.7
45 and over	1,262	0.5	14	1.1
Unknown	769	0.3	34	2.7
TOTAL	271,522	100.0	1,270	100.0
		NEGRO		
10 - 14	146	0.9	1	0.6
15 - 19	3,621	23.1	32	18.5
20 - 24	4,485	28.7	33	19.8
25 - 34	5,045	32.3	62	35.8
35 - 44	2,187	14.0	37	21.4
45 and over	95	0.6	6	3.5
Unknown	62	0.4	2	1.2
TOTAL	15,641	100.0	173	100.0

COMPARISON BETWEEN NUMBER OF CERTIFICATES REPORTING MATERNAL DEATHS AND THE NUMBER TABULATED AS MATERNAL DEATHS

The Division of Vital Statistics, United States Census Bureau, has made a comparison between the number of certificates reporting puerperal conditions and the number actually tabulated as maternal deaths. (1936)

TABLE VI

PERCENTAGE OF CERTIFICATES REPORTING PUERPERAL CAUSE BUT TABULATED UNDER SOME OTHER CAUSE

Cause	Percentage
Abortion with septic conditions	11.5
Abortion without septic conditions	44.3
Ectopic gestation, septic conditions specified	0.0
Ectopic gestation, septic conditions not specified	1.1
Other conditions of pregnancy	92.5
Placenta praevia	12.1
Other puerperal hemorrhages	44.4
Puerperal septicemia	1.6
Puerperal albuminuria and eclampsia	15.2
Other toxemias of pregnancy	50.9
Puerperal phlegmasia alba dolens, embolus, sudden death	43.0
Other accidents of birth	67.1
Unspecified conditions	54.9
All causes	11.0

"A check of death certificates of every woman dying between 15 - 45 revealed 28% more deaths occurred from causes connected with childbirth than could be discovered

through official reports."[1]

Although the exact percentages would not hold for any particular State, this is at least an indication that many puerperal conditions are not being reported as maternal deaths. This is to say that the problem of maternal mortality is greater than the rates indicate.

The puerperal rate, as established by a survey made in Philadelphia, compared with the Bureau of Vital Statistics of Philadelphia:

Year	Survey	Vital Statistics Bureau
1931	7.3	5.7
1932	7.4	6.3
1933	5.2	4.4

Errors on death certificates prevented correct coding in 21.6% of cases. The highest percentage of error given was for puerperal septicemia and ectopic gestation.[2]

In the study of maternal deaths in New York City, the investigation yielded information which established as the cause of death some condition which could not be established from an examination of the death certificates. There was incorrect coding in 17.8% of the certificates.

[1] Bolt, R. A., M.D. - Reduction of Maternal Mortality in Cleveland, Journal of American Medical Association, April 1939, Page 1543.

[2] Maternal Mortality in Philadelphia, 1931-1933, Page 20.

TABLE VII

MATERNAL DEATHS BY CAUSE - PERCENTAGE OF TOTAL MATERNAL DEATHS FOR EACH YEAR

KENTUCKY - 1932-1939

CAUSE OF DEATH	1932	1933	1934	1935	1936	1937	1938	1939
Abortion	7.3	14.5	11.7	12.1	16.0	18.5	14.5	17.1
Ectopic gestation	0.4	2.6	1.9	2.1	4.8	1.2	3.8	0.4
Other conditions of pregnancy	16.4	10.2	11.3	10.4	10.6	5.2	3.4	7.5
Puerperal hemorrhage	5.9	7.6	8.4	11.4	8.5	10.8	10.3	13.5
Puerperal septicemia	23.4	26.2	27.2	22.5	18.8	21.7	14.5	13.9
Puerperal albuminuria and eclampsia	15.4	15.6	10.4	12.5	10.6	12.4	17.6	13.5
Other toxemias of pregnancy	2.1	3.6	3.6	3.9	5.4	8.8	8.0	8.3
Puerperal phlegmasia, a lba dolens, embolus, sudden death	1.4	0.4	0.0	0.0	0.4	0.4	1.9	0.4
Other accidents of birth (operative and other)	26.6	17.5	25.2	24.6	24.9	20.9	25.6	25.4
Other unspecified conditions	1.1	1.8	0.3	0.4	0.0	0.0	0.4	0.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

MATERNAL DEATHS BY CAUSE

Puerperal septicemia is the principal cause of maternal deaths both among whites and Negroes. Approximately one-fourth of the total number of deaths for the five year period (1932 - 1936) were from this cause. Age is not an important factor. The rate for the Negro, 2.1 deaths per 1,000 live births, is in excess of that for the white race, 1.4 deaths per 1,000 live births.

The most frequent cause of death, with the exception of septicemia, is the group included under albuminuria and eclampsia. This classification is defined to include only those kidney and liver disturbances which arise directly as a result of pregnancy and not true nephritis. The differentiation is difficult, as the symptom complex is similar. According to the maternal death certificates, 12.8% of the total puerperal deaths were from this cause. The percentage of deaths from albuminuria and eclampsia was greatest in the 15 - 19 age group (26.3%).

Deaths from puerperal hemorrhage show a tendency to increase with age. Death certificates do not show the segregation of puerperal hemorrhages into postpartum hemorrhages and placenta praevia. Approximately 8% of all the maternal deaths are from this cause.

Other toxemias of pregnancy are comprised mostly of deaths from pernicious vomiting of pregnancy. Deaths from this cause make up 3.7% of the total maternal deaths, 3.3% of the total white deaths and 7.8% of the Negro deaths. If characteristics of deaths from abortions were segregated, the true cause of death in some of the cases would probably be found to have been pernicious vomiting.

The number of deaths assigned to phlegmasia alba dolens, embolus, and sudden death are statistically insignificant and are here presented only as a matter of interest. During the 5 year period (1932 - 1936) there were 6 deaths ascribed to this cause.

The deaths from this specific cause represent a fixed and irreducible element in the inevitable deaths arising out of childbearing.

Twenty-four percent of the total deaths are ascribed to other accidents of birth. Not much can be said about deaths under this caption, because no segregation is made as to the specific causes included under it. Cases in which death was ascribed to the effects of labor and the accidents occurring in its course, shock associated with operative delivery, rupture and inversion of the uterus, and neglected cases of obstructed labor are grouped under "other accidents of birth."

ABORTION

Consideration of abortion as the cause of death is most inaccurate and unsatisfactory. The difficulties surrounding the study and evaluation of abortion are, in many instances, those surrounding criminal activity. Wilfully false reporting is the main source of error. Many cases are likely not classified as puerperal deaths, but are included in general death rates. From the certificates there is no satisfactory way of determining which were induced and which were truly spontaneous.

During the years 1934, 1935, and 1936 reported deaths from abortion showed a relative increase. The increase, both actual and relative, of the deaths in 1933 over 1932 is especially noted. (See Table XII)

When the deaths are considered for the five year period, 12% are due to abortion. (Table VIII). The distribution of these deaths according to age groups offers some interesting features. (Table IX)

TABLE VIII

MATERNAL DEATHS BY CAUSE AND PERCENTAGE OF TOTAL

KENTUCKY, 1932 - 1936

Cause	White	Percentage of Total	Negro	Percentage of Total	Total	Percentage of Total
Abortion	152	11.9	26	15.0	178	12.3
Ectopic gestation	25	2.0	9	5.2	34	2.7
Other conditions of pregnancy	154	12.1	16	9.2	170	11.7
Hemorrhage	108	8.5	13	7.5	121	8.4
Puerperal septicemia	310	24.4	33	19.1	343	23.7
Puerperal albuminuria and eclampsia	167	13.2	18	10.4	185	12.8
Other toxemias of pregnancy	42	3.3	12	6.9	54	3.7
Puerperal phlegmasia alba dolens, embolus, sudden death	4	0.3	2	1.2	6	0.4
Other accidents of birth	301	23.7	43	24.9	344	23.8
Unspecified conditions	7	0.6	1	0.6	8	0.5
TOTAL	1,270	100.0	173	100.0	1,443	100.0

TABLE IX

DEATHS FROM ABORTION AND PERCENTAGE OF TOTAL MATERNAL DEATHS BY AGE OF MOTHER

KENTUCKY, 1932 - 1936

Age Group	Total Deaths	DEATHS FROM ABORTION	
		Number	Percentage of Total Deaths
10 - 14	9	0	0.0
15 - 19	190	20	10.5
20 - 24	319	44	13.8
25 - 29	285	34	11.9
30 - 34	234	43	16.6
35 - 39	235	20	7.2
40 - 44	115	12	9.6
45 and over	20	3	--
Unknown	36	2	--
TOTAL	1,443	178	12.3

It is expected that the largest percentage of deaths following abortion would be in the lowest age group. This was found to be true in the New York study, but in Kentucky this is not the case. The age group having the highest proportion of deaths due to this cause was 30 - 34 years, with 43 deaths or 16.6% of all maternal deaths in that group. The age group 20 - 24 was next highest, with 44 deaths or 13.8%.

Fifteen percent of the total puerperal deaths among the Negroes were from effects of abortion; while among the white population they constituted 12%. The New York study of maternal deaths, made by careful investigation of 2,041 deaths shows 17.5% of the total maternal deaths to have followed abortion. Preventability of the deaths in this group is high. The problem of deaths from abortion is primarily a social one, but when it comprises 12.3% of all maternal deaths it also has an

important medical aspect.

ECTOPIC GESTATION

Symptoms of this disease often lead to a diagnosis of a surgical abdomen. Therefore, it is likely there were more deaths from this cause than were reported. Only 2.4% of all maternal deaths were reported as caused by ectopic gestation. The New York study shows 5.9% of the total maternal deaths, Philadelphia study 4.6%.

Twenty-five of the deaths were of white women - 2% of the white maternal deaths; 9 were Negro - 5.2% of all Negro maternal deaths.

A high percentage of women dying from ectopic gestation were operative cases. The shock incident to operation is too great for the reduced recuperative powers of women coming to operation in such a critical condition.

Women should have proper instruction of the possible gravity of symptoms which at first may seem mild in character.

TABLE X

DEATHS FROM ECTOPIC GESTATION AND PERCENTAGE OF TOTAL MATERNAL DEATHS

BY AGE OF MOTHER - KENTUCKY, 1932 - 1936

Age Groups	Total Deaths	DEATHS FROM ECTOPIC GESTATION	
		Number	Percentage of Total Deaths
10 - 14	9	1	11.1
15 - 19	190	2	1.1
20 - 24	319	5	1.6
25 - 29	285	9	3.2
30 - 34	234	10	4.3
35 - 39	235	2	0.9
40 - 44	115	4	3.5
45 and over	20	1	5.0
Unknown	36	0	0.0
TOTAL	1,443	34	2.4

PUERPERAL HEMORRHAGE

Deaths from this cause show a tendency to increase with age. The survey does not show the segregation of puerperal hemorrhages into postpartum hemorrhages and placenta praevia. More than 8% of all the white maternal deaths are from this cause. Among Negroes, the percentage is 7.5% of total.

A very high percentage of deaths from puerperal hemorrhage are considered preventable. The greatest responsibility is ascribed to the physicians. There is no one particular defect which, if corrected, would improve the situation. There must be:

(1) Education of the women as to the seriousness of bleeding during pregnancy.

(2) Delivery skillfully conducted.

(3) No delay in use of all means for control of hemorrhage.

TABLE XI

DEATHS FROM PUERPERAL HEMORRHAGE AND PERCENTAGES OF TOTAL MATERNAL DEATHS

BY AGE OF MOTHER - KENTUCKY - 1932 - 1936

Age Groups	Total Deaths	DEATHS FROM PUERPERAL HEMORRHAGE	
		Number	Percentage of Total
10 - 14	9	0	0.0
15 - 19	190	8	4.2
20 - 24	319	21	6.6
25 - 29	285	26	9.1
30 - 34	234	27	11.5
35 - 39	235	25	10.6
40 - 44	115	9	7.8
45 and over	20	3	15.0
Unknown	36	2	5.5
TOTAL	1,443	121	8.4

PUERPERAL SEPTICEMIA, TETANUS

Puerperal septicemia is the principal cause of maternal deaths both among whites and Negroes. Approximately one-fourth of the total number of deaths for the five year period (1932-1936) were from this cause. The distribution of the cases by age is given in Table XII. It is noted that age is not an important factor in deaths from septicemia. Twenty-four percent of the total maternal deaths were from this cause; 24% of all white maternal deaths and 19% of the Negro. The rate for the Negro, 2.1 deaths per 1,000 live births, is in excess of that for the white race -- 1.4 deaths per 1,000 live births.

TABLE XII

DEATHS FROM PUERPERAL SEPTICEMIA AND TETANUS AND PERCENTAGES OF TOTAL MATERNAL DEATHS BY AGE OF MOTHER, KENTUCKY - 1932 - 1936

Age Groups	Total Deaths	DEATHS FROM SEPTICEMIA AND TETANUS	
		Number	Percentage of Total
10 - 14	9	2	22.0
15 - 19	190	40	21.0
20 - 24	319	97	30.4
25 - 29	285	53	18.6
30 - 34	234	49	20.9
35 - 39	235	71	30.2
40 - 44	115	23	20.0
45 and over	20	1	5.0
Unknown	36	7	19.4
TOTAL	1,443	343	23.8

PUERPERAL ALBUMINURIA AND ECLAMPSIA

The most frequent cause of death, with the exception of septicemia, is the group included under albuminuria and eclampsia. This classification is defined to include only those kidney and liver disturbances which arise directly as a result of pregnancy and not true nephritis. The differentiation is difficult, as the symptom complex is similar. According to the maternal death certificates, 12.8% of the total puerperal deaths were from this cause. The percentage of deaths from albuminuria and eclampsia was greatest in the 15 - 19 age group (26.3%).

With proper care a very small percentage of deaths from this cause is considered unavoidable. The possibilities of lowering the death rate becomes very significant when the patients have adequate prenatal care. Education of women to the vital necessity of putting themselves under supervision early in pregnancy and cooperating with the physician throughout the prenatal period is extremely important.

TABLE XIII

DEATHS FROM PUERPERAL ALBUMINURIA AND ECLAMPSIA AND PERCENTAGE OF TOTAL MATERNAL DEATHS BY AGE OF MOTHER, KENTUCKY - 1932 - 1936

Age Groups	Total Deaths	DEATHS FROM PUERPERAL ALBUMINURIA AND ECLAMPSIA	
		Number	Percentage of Total
10 - 14	9	1	11.0
15 - 19	190	50	26.3
20 - 24	319	43	13.5
25 - 29	285	34	11.9
30 - 34	234	24	10.2
35 - 39	235	15	6.4
40 - 44	115	12	10.4
45 and over	20	1	5.0
Unknown	36	5	13.9
TOTAL	1,443	185	12.8

OTHER TOXEMIAS OF PREGNANCY

Other toxemias of pregnancy are comprised mostly of deaths from pernicious vomiting of pregnancy. Many of these deaths are preventable[1] if the patient seeks medical assistance early. Refusal to have operation when advised is often fatal. Deaths from this cause make up 3.7% of the total maternal deaths -- 3.3% of the total white maternal deaths and 7.8% of the Negro deaths.

If characteristics of deaths from abortions were segregated the true cause of death in some of the cases would probably be found to have been pernicious vomiting.

PHLEGMASIA ALBA DOLENS, EMBOLUS, SUDDEN DEATH

The number of deaths assigned to this cause are statistically insignificant and are here presented only as a matter of interest. During the five year period (1932 - 1936) there were 6 deaths ascribed to this cause. Often there is a septicemia which might give rise to fatal septic emboli. In such cases, the true cause of death would be septicemia. The deaths from this specific cause represent a fixed and irreducible element in the inevitable deaths arising out of childbearing.

OTHER ACCIDENTS OF BIRTH

Twenty-four percent of the total deaths are ascribed to "other accidents of birth". Not much can be said about deaths under this caption, because no segregation is made as to specific causes included under it. Cases in which death was ascribed to the effects of labor and the accidents occurring in its course, shock associated with operative delivery, rupture and inversion of the uterus, and neglected cases of obstructed labor are grouped under "other accidents of birth."

Reduction of deaths from this cause must be affected through an improvement in skill and judgment of the physician. As with all causes of puerperal deaths, more prompt procuring of competent consultation early in abnormal labor is also a requisite of lessening the number of deaths.

[1] New York and Philadelphia Studies. See References.

PREVENTABLE DEATHS

In regard to maternal deaths which were preventable, it is difficult to estimate to what extent the experience of urban New York and rural Maryland may be comparable to Kentucky. It is, however, our opinion that the percentage of deaths which might have been prevented is well over 50%, using as a standard a liberal interpretation of "preventability". After an exhaustive study of 2,041 maternal deaths in New York City, it was concluded that 65.8% must be classed as preventable. Approximately two-thirds of the 447 deaths analyzed in rural Maryland were "strictly" preventable. The Analysis Committee on Maternal Mortality in Philadelphia felt the standard adopted by the New York Committee was too rigid and inflexible. The standard in Philadelphia was "a reasonable degree of learning and skill and use of reasonable care and diligence in the exercise of that skill and application of that learning". Upon this basis, 56.7% of the 717 deaths studied were considered preventable.

A five year study of Maternal Mortality in Jefferson County, Alabama, developed that 78% of the deaths were preventable, according to the committee of obstetricians.

IMPORTANCE OF PRENATAL CARE

The value of prenatal care as an essential in good maternal care has been increasingly appreciated since 1858, when the first prenatal clinic was established by accident at Dublin Maternity Hospital. Expectant mothers were required to report early in pregnancy to insure beds for themselves in the hospital for confinement. But, like many other discoveries, there was a lag between the origin and application. According to recent studies, only a small percentage receive what can be considered good prenatal care.

Other studies of maternal mortality surveys show that approximately two-thirds of the women who died because of childbearing had received inadequate or no prenatal

care. Of the preventable deaths more than one-third were due to failure of the patients themselves to take advantage of those facilities which are at hand for safeguarding them in the period of gestation and lying in.[1]

Tuberculosis, heart disease, and nephritis contribute substantially to the number of puerperal deaths. Reduction demands early diagnosis and intelligent management.

Not enough can be said about the importance of prenatal care. This element is one of education. Health workers have a responsibility for getting pregnant women under medical care. The medical profession must accept this responsibility for educating the lay public to a better understanding of the aims of obstetrics and methods by which these aims may be realized.

Future progress in lowering maternal deaths will depend upon the degree to which medical, nursing, and hospital facilities are made available to the neglected areas and groups of people.

Type of organization and character of the techniques have been thoroughly developed in a large number of centers. These must be made more general, so that every section is covered, in the services to the colored people as well as to those in the more privileged groups.

Even with facilities available, there will still be the problem of educating expectant mothers to take advantage of the care that is available.

[1] Gerdes, Maude M.: Newer Concepts and Procedures of Maternal Care, Journal of American Public Health Association, September, 1939.

RELATIVE DECREASE OF INFANT AND MATERNAL DEATH RATES

In general, the infant and maternal death rates declined at relatively the same rate until 1930. Since this date the consistent decline of the maternal death rate has not been paralleled by the infant death rate. In 1936 only, has the maternal death rate been higher than the preceeding year. From 1930 through 1938 the infant death rate has varied from year to year. The increase in 1936, however, is also noted in this rate.

It is of interest to note that since 1932 the decline of the neonatal[1] rate has paralleled that of the maternal death rate rather than that of the infant[2] death rate. This is an indication of the relationship between neonatal and maternal deaths.

MATERNITY NURSING SERVICE

In an effort to lower the maternal and neonatal mortality rates, a maternity nursing service has been established in 10 counties in Kentucky. The counties chosen for the service must have a sufficient number of physicians cooperating with the service to make available to each expectant mother the services of an attending physician. Other requirements are: the neonatal and maternal mortality rates must be so high that additional help is necessary to lower them.

The purpose and procedure of the service are described in the "Standing Orders for Maternity Nursing Service" as set up by the Division of Maternal and Child Health of the State Department of Health.

[1] Neonatal - under one month
[2] Infant - under one year

Purpose of Service: To provide nursing care during antenatal, natal and postnatal periods to all medically indigent mothers within the confines of the county who are registered with the County Health Department four months prior to delivery. The nurse may assist the physician even though the patient is not registered, if a real emergency exists, as determined by the County Health Officer.

To provide physicians with nursing delivery service while attending patients at delivery. The nurse shall be at the home only at the time the physician is in attendance, except in dire emergencies, as determined by the County Health Officer.

ANTEPARTUM NURSING CARE

Frequency of Visits: The frequency and content of the nurse's home visit will be determined by the need of the individual patient. A written report of the visit will be sent to the physician, in any apparently normal case, once a week. If the findings at the time of the visit are abnormal, a telephone report will be made to the physician as soon as possible and immediately followed by a written report.

Visit Routine: Temperature, pulse rate and blood pressure are to be taken at each visit. A urine specimen is to be secured from the expectant mother and urinalysis done. Blood for serological and coagulation tests is to be taken, unless otherwise ordered by the physician. If the patient is not seen antenatally, blood is to be secured at the time the patient is contacted.

Antepartum Hygiene: The nurse will urge the expectant mother to carry out the physician's orders, and will assist her in doing so. She will be given advice concerning diet, exercise, rest, care of the breasts and the correct clothing. She will be instructed by demonstration in preparing supplies and clothing for her during confinement, and also for the baby.

POSTPARTUM NURSING CARE

Frequency of Visits: Visits will be made on the third day, sixth day and fourth week when possible. A written report of the first postpartum visit will be sent to the physician.

Visit Routine:

For Mother: Temperature and pulse rate will be taken at each visit. The mother will be given advice concerning perineal care and care of the breasts as well as helpful exercise. Every mother will be urged to go to her doctor for a postpartum examination six weeks after delivery.

For Infant: The mother will be advised how to feed, clothe and care for the baby. At the time she goes to the physician for a postpartum examination, she should take the baby for examination also. It is advisable to set a date on this occasion to have the infant immunized against smallpox and diphtheria within the first year.

Evaluation of the service since organization (during 1938) is extremely difficult to make. Besides the short period of organization, the service is limited to the mothers in a very selective group -- those economically and medically indigent. No control group is satisfactory, since a corresponding group chosen in a county in which there were no maternity nursing would not be comparable on the basis of economics, medical facilities, etc.

It is commonly believed that economic status greatly affects the maternal and neonatal death rates.[1] If this be true, aid in reducing the rates of the group which are indigent will reflect in the total rates of the counties where the service is being used.

MATERNAL DEATH RATES BY DISTRICTS

Maternal death rates are studied by Kentucky Public Health Districts. There are eight of these districts set up for education units. (Map I) Because of economic levels, the needs of the districts vary within the State. For the period 1932-1936 the highest rate observed was in the Jackson Purchase Area. This district is below the average for the State as a whole in economic status, and the percentage of Negro population, among whom the maternal death rate is greatest, is high. Districts with

[1] Dublin, Louis I.: Problem of Maternity; Journal of American Public Health Association, November, 1939, page 1213.

the highest maternal mortality rates (5 per 1,000 live births or greater) have the largest urban centers in the State. The urban rates are consistently higher than the rural rates. This may be due to the fact that non-residents are brought into these areas to the hospitals. More than 50% of the Negroes in the State live in urban centers.

It is of interest and importance to the medical profession, to note that the districts in which the maternal death rates are lowest are those in which there are fewest physicians.[1]

[1] Report of Committee on Medical Economics; Bulletin of State Department of Health, August, 1939, Pages 8 and 22.

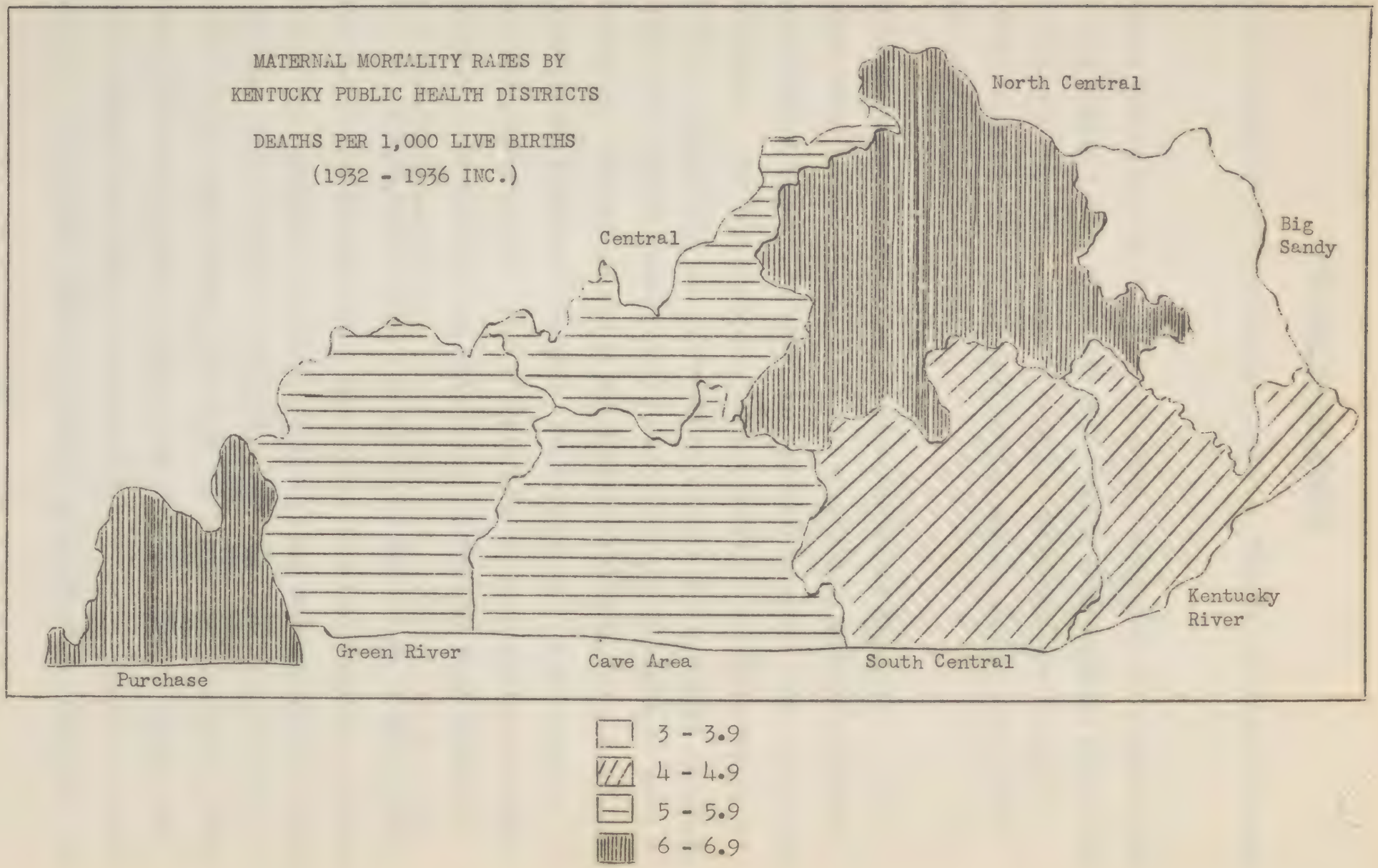
TABLE XIV

MATERNAL DEATH RATES BY DISTRICTS - KENTUCKY

DEATHS PER 1,000 LIVE BIRTHS FOR RURAL AND URBAN AREAS

1936, 1937, 1938, 1939

Districts	1936			1937			1938			1939		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Big Sandy	3.7	11.1	4.4	3.7	12.7	4.6	2.5	15.5	3.8	3.3	9.9	4.0
Cave Area	6.1	21.5	6.7	4.0	3.8	4.0	3.2	9.9	3.6	4.7	6.8	4.8
Central Area	4.4	3.5	4.1	2.1	6.7	5.1	3.0	4.4	4.0	2.0	4.6	3.7
Green River	6.0	4.2	5.7	4.6	7.9	5.2	3.3	8.3	4.2	2.6	5.3	3.1
Jackson Purchase	5.8	13.7	7.8	4.5	6.9	4.9	5.4	3.3	5.0	4.8	6.0	5.0
Kentucky River	6.2	0.0	6.2	4.3	0.0	4.3	4.5	0.0	4.3	4.3	0.0	4.3
North Central	3.4	8.7	5.9	2.9	6.3	4.1	4.0	6.0	4.7	3.9	6.0	4.6
South Central	4.1	11.7	4.3	2.9	26.9	3.5	3.7	35.7	4.5	3.8	11.3	4.1
STATE	4.9	6.7	5.3	3.6	7.5	4.4	3.6	6.7	4.2	3.8	5.7	4.1


MATERNAL MORTALITY RATES BY
KENTUCKY PUBLIC HEALTH DISTRICTS
DEATHS PER 1,000 LIVE BIRTHS
(1932 - 1936 INC.)
North Central
Big Sandy
Central
Kentucky River
Green River
Cave Area
South Central
Purchase
3 - 3.9
4 - 4.9
5 - 5.9
6 - 6.9

FRONTIER NURSING SERVICE

The following paragraphs are quoted from a pamphlet, "What is the Frontier Nursing Service?"

"The Frontier Nursing Service, Inc., is a voluntary organization for remotely rural work, which maintains a corps of trained public health nurse-midwives, under a medical director, carrying out a program to prevent, control and nurse disease; to deliver women in childbirth. It provides doctors, nurses, medical and hospital facilities for those needing such care.

The Service was founded in 1925 in the mountains of Eastern Kentucky; in a land without good roads; without transportation or communication; where an eighteenth century civilization continued to exist over thousands of square miles in the heart of modern America. This area was chosen because nowhere in the United States are the difficulties facing rural health administration more acute; because the people of this region are American stock, handicapped by geographical conditions and not in native ability. The area covered is approximately 700 square miles located in Leslie, Clay and Perry Counties (see map). The Service has 17 nurse-midwives, including the supervisory staff. Some of these received their nursing and public health training in the United States, and all but one received their midwifery training in Scotland or England; they were recalled for service in the European war (1939) but are temporarily replaced by nurse-midwives trained at the Frontier. The Service was started because mothers were having their babies without any trained assistance; because epidemics of typhoid, diphtheria, and smallpox spread, unchecked, over large areas; because sanitation and hygiene were unknown; because doctors, owing to the poverty of the country, were unable to make a living, and were, therefore, almost unobtainable; because hospital facilities were totally lacking over large areas; because these people are American citizens and as such are entitled to some measure of the health protection provided in our cities to all who come to our

shores.

Three thousand deliveries without a maternal death as a direct result of pregnancy and with the loss of only four mothers, from pneumonia and heart disease, resulting in a maternal death rate of only 1.3 per 1,000 live births -- one of the lowest in the world; one-third less infant deaths within one month after birth, than occur in the general white population of Kentucky. In addition to this maternal and child health program, extensive work has been done in other fields of medical service."

Statistical reports of 3,000 midwifery records of the Frontier Nursing Service have been made by the Metropolitan Life Insurance Company, and submitted to the Service by Dr. Louis I. Dublin, Statistician of the Corporation. Summaries of the reports are included in this study.

Two factors influencing maternal mortality materially are age of mother and order of birth. The larger than average proportion of women in the earliest and most advanced age groups would tend to increase mortality. The hazards of pregnancy increase after the fifth or sixth confinement. The risk involved being greater than in the first delivery.[1] In the group of Frontier mothers the proportion of first births was low - 19.7%. Twenty and five-tenths percent of the live births were of the 7th or later para.

The Service has made real progress in the matter of early registration of mothers, and is securing the registration of young mothers at even earlier dates than the older women. It is hoped that the education of the women over a period of years will make early registration an accepted procedure.

[1] Investigation into Maternal Mortality: Ministry of Health, London, 1937.

In the third 1,000 confinements of the Frontier Nursing Service, 32% of the mothers were registered before the sixth month. This compares favorably with 21% in the second 1,000 confinements and 18% in the first.

In 2,000 cases there were no maternal deaths, although two deaths were charged to chronic conditions. In the third thousand cases were two pneumonia deaths, which under joint cause of death procedure would be charged to the puerperal state. The infant mortality rate during the first month, or the neonatal rate, was rather high-39 deaths in 980 births. Almost two-thirds of these deaths were premature babies. The adverse effect of the early termination of pregnancy is well illustrated here.

The neonatal rate for the three studies made are: first 1,000, 25.3 deaths for 1,000 live births, second 26.5 and third 39.8.

TABLE XV

NUMBER OF PUERPERAL COMPLICATIONS AND OPERATIONS IN THE FIRST, SECOND AND THIRD 1,000 DELIVERIES - FRONTIER NURSING SERVICE

	First	Second	Third
Puerperal complications during pregnancy	287	193	182
Puerperal complications during labor	366	277	235
Puerperal complications during puerperium	89	83	117*
Operations necessary	10	7	7

* The inclusion of "subinvolution of uterus" as a complication this time is responsible for the apparent rise in complications.

An outstanding feature of the experience is the small number of cases where interference was necessary. In the third 1,000 cases there was one Cesarean, one low forceps, one episitomy, and four internal version under anaesthesia.

For the three studies the number of operations are: first, 10; second, 7; third, 7. To appreciate these figures, it may be well to recall that in New York, where most of the cases are attended by doctors, it is estimated that 20% of all deliveries are operative and almost one-half of the operations are Cesarean sections. Of the live births in the Frontier Service only 5% of the deliveries are made by the doctor, the medical director of the service.

Approximately 82% of 3,000 cases were delivered by the nurse, and in 13% of the cases the nurse arrived after the baby was born. Because the condition of the mother was known to be disturbing, the doctor was present in approximately 4% of the cases, the nurse making the delivery with the doctor present.

Only 8.5% of the total cases were delivered in the hospital or a nursing service center.

After a month of postpartum care, 961 of the third 1,000 women were found in a satisfactory condition, compared with 958 and 955, respectively, in the previous 2,000.

TABLE XVI

COMPARISON OF FIRST THOUSAND, SECOND THOUSAND, AND THIRD THOUSAND MIDWIFERY RECORDS

THE FRONTIER NURSING SERVICE, INC.[1]

	First 1,000 Records	Second 1,000 Records	Third 1,000 Records
Total pregnancies	1,004	1,000	1,000
Delivered --			
At term	962	959	931
Before term	42	41	69
Live births	989	982	980
Still births	26	23	31
Late abortions	1	6	*
Condition of Mother at end of first month --			
Fair	44	43	27
Satisfactory	958	955	961
Unsatisfactory	0	2	7
Not specified	0	0	3
Dead at end of first month --			
Mother	2	0	2
Baby	25	26	39

[1] Reports submitted to the Frontier Nursing Service by the Statistical Department of the Metropolitan Life Insurance Company.

* Not given.

ADDITIONAL STATISTICAL NEEDS FOR PROPER ADMINISTRATION OF MATERNAL PROGRAMS

In order to answer many of the questions about the complications of pregnancy relative to maternal, neonatal and infant deaths, the Children's Bureau, in cooperation with the Bureau of Census, recommended revised birth and death certificates now in use in Kentucky. On the standard death certificate under "Other conditions causing death" there is the parenthetical note (Include pregnancy within three months of death). Sometimes as many as one-fourth of all maternal deaths are recorded under "Other causes", because of failure to mention pregnancy on the death certificate. More knowledge is needed about the role pregnancy plays in causing many deaths now assigned to heart disease, chronic nephritis, and other conditions which might not have caused death if pregnancy had not occurred.

Supplemental information on the live birth and stillbirth certificates includes (1) complications of pregnancy, (2) complications of labor, and (3) nature of operation for delivery.

Further analysis should be made of maternal, neonatal, and stillbirth mortality in relation to the type and size of hospital where death occurred.

It is almost universally believed that puerperal deaths are closely connected with economic status. No study has been made in Kentucky to verify this assumption.

Exact data to show the importance of prenatal care are needed.

Investigation of the maternal death rates in districts where the medical facilities are least available would be of importance.

SUMMARY

1. The maternal death rate in Kentucky has shown only a slight decline since 1911, and this reduction has been practically the same as that for the United States as a whole.

2. The maternal mortality is higher in the urban than in rural areas. The Negro urban rates are highest of any observed (1932-1936). In this study the urban rates have declined over the five-year period, while the rural rates show a slight increase.

3. The maternal mortality of Negro mothers exceeds that of white mothers in each group. The total Negro rate is more than twice as great as that for the white.

4. The lowest rates observed for both white and Negro were in the age group 20 - 24 years.

5. Indications of other studies are that deaths from many puerperal conditions are not being reported as maternal deaths.

6. Puerperal septicemia is the principal cause of death in 24% of the total deaths. Puerperal albuminuria, eclampsia and abortion are next in importance, as causes of death.

7. An increase in the percentage of deaths after abortion is noted, over a period of five years. This is also true of ectopic gestation. Decreases are noted in the percentage of deaths from septicemia and eclampsia.

8. It is believed that the percentage of deaths which might have been prevented is well over fifty.

9. The decline of the neonatal rate has paralleled that of the maternal death rate since 1932.

10. The Frontier Nursing Service is a voluntary organization, providing trained public health nurse-midwives to a remote rural section of Kentucky. In 3,000 deliveries, there has been no maternal death, as a direct result of pregnancy, and a loss of only four mothers from pneumonia and heart disease. This results in a maternal death rate of 1.3 per 1,000 live births.

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